

## REMARKS

Claims 1, 4-7, and 10 are pending in the present Application. No claims have been canceled, Claims 1 and 5 have been amended, and no claims have been added, leaving Claims 1, 4-7, and 10 for consideration upon entry of the present Amendment.

### Interview Summary

A telephonic interview was held between the Examiner (Davis) for the above-identified case, and Applicant's agent (Gronbeck), to discuss both the proposed amendments to Claim 1 to remove the "product by process" allegations, referred to for sake of simplicity as Proposed Amendment A;

1. (Currently amended) A cathode for a battery, consisting of:

(a) cathode active material particles;

(b) metal hydroxide particles having a specific surface area of between 2.5 m<sup>2</sup>/g and 100 m<sup>2</sup>/g, as a cathode additive;

(c) a conductive agent; and

(d) a binder,

wherein the metal hydroxide particles ~~added to~~ in the cathode are present in an amount of greater than 0 wt% and less than 10 wt%, and the cathode active material particles and the metal hydroxide particles in the cathode are ~~uniformly mixed~~ a uniform mixture with each other.

and to the proposed alternate amendment to Claim 1 to remove the product by process allegations and to limit the claim to recited metal oxides Al(OH)<sub>3</sub> and Mg(OH)<sub>2</sub> having defined ranges of particle sizes, referred to as Proposed Amendment B:

1. (Currently amended) A cathode for a battery, consisting of:

(a) cathode active material particles;

(b) metal hydroxide particles having a specific surface area of between 2.5 m<sup>2</sup>/g and 100 m<sup>2</sup>/g, as a cathode additive;

(c) a conductive agent; and

(d) a binder,

wherein the metal hydroxide particles ~~added to~~in the cathode are present in an amount of greater than 0 wt% and less than 10 wt%, and the cathode active material particles and the metal hydroxide particles in the cathode are ~~uniformly mixed~~ uniform mixture with each other

wherein the metal hydroxide is  $\text{Al}(\text{OH})_3$  having an average particle size of 0.8  $\mu\text{m}$  to 8  $\mu\text{m}$ , or  $\text{Mg}(\text{OH})_2$  having an average particle size of 1.0  $\mu\text{m}$  to 9  $\mu\text{m}$ .

Both the proposed claim amendments A and B were sent to the Examiner by fax on April 20, 2010 for review in advance of the interview.

During the interview, the Examiner informed Applicants agent indicated that the proposed alternative Claim 1 (Proposed Amendment B) was both acceptable in form and appeared free of the cited art, and that according to the Examiner should be allowable, pending a final search and consideration of any further art submitted by information disclosure statement.

However, we also expressed to the Examiner that while not ungrateful for the indication of potential allowability in the Proposed Amendment B, the alternative claim 1 of Proposed Amendment B was intentionally narrower and intended as a fall-back position, and that we wished to also discuss the Proposed Amendment A, where Claim 1 is amended only to remove “product by process” limitations, as we believed the Examiner may not have fully considered all arguments and amendments presented in the previous Response (filed December 31, 2009) to the Office Action dated September 30, 2009.

Applicant’s agent pointed out to the Examiner that Claim 1 had been amended in the previous Response to “consist of” the recited elements and therefore has closed claim language, and that the secondary reference, U.S. Patent No. 4,913,988 to Langan (used in combination with the primary reference U.S. Patent No. 6,998,071 to Maeda to reject Claim 1 as allegedly obvious) clearly teaches that any unexpected benefits of “superior low temperature performance” are achieved where a combination of *both* a metal hydroxide ( $\text{Ca}(\text{OH})_2$ ) *and* lithium carbonate are used. Because Claim 1 as previously amended to “consist of” the recited elements by definition excludes added lithium carbonate, there would be no expectation for the improved low temperature performance of Langan. This point was presented in the previously filed Response.

Applicant's agent further pointed out that as argued in the previous Response, to remove lithium carbonate from Langan to meet the requirements of Claim 1 would change the principle of operation of Langan and would render it unsuitable for its intended purpose, and therefore there is no suggestion or incentive to modify the references to remove this element in order to meet the requirements of instant Claim 1. At the end of the interview, Applicant's agent requested the Examiner consult with her supervisory examiner and discuss these arguments. The Examiner subsequently called us back and acknowledged that, because these arguments and amendments may not have been fully considered in conjunction with the prior amendments to Claim 1 to use "consisting of" language, the Examiner and her supervisor agreed to reconsider these arguments if submitted, but would not indicate whether Claim 1, amended as in Proposed Amendment A, would necessarily be determined to be allowable without an in-depth reconsideration.

Applicants wish to thank the Examiner for the courtesy shown Applicant's agent in agreeing to the interview and for the Examiner's candid and helpful comments. Should the Examiner disagree with the content or completeness of the above summary, it is respectfully requested that the Examiner so inform Applicant's agent so that any corrections to the record may be made.

#### Amendments to Claims

Claims 1 and 5 have been amended to remove the term "added to" and replace it with "in", and to replace the term "uniformly mixed" with the term "uniform mixture" to convey clearly that the claim is a product claim, and not a product by process claim as alleged. Support for these amendments can be found at least in the Specification, published as PCT/KR2004/001897, on p. 4, line 9-15 and p. 9, lines 8-12.

Further support for the cathode active material being a uniform mixture in Claims 1 and 5 can be found in the Examples (see e.g., Example 1) in which it is disclosed that the cathode active material, trihydroxyaluminum particles (i.e., a metal hydroxide) and conductive agent and binder "are added to prepare mixed slurry for a cathode" where it will be appreciated that a mixed slurry is a homogeneous dispersion of all of these ingredients, and the combination of these ingredients, i.e., the cathode active material particles and metal hydroxide particles, are present as a uniform mixture after being uniformly mixed. Applicants

therefore believe based on the teachings of the disclosure that the cathode active material particles and the metal hydroxide particles form a uniform mixture is intrinsic to the disclosure. Please note especially that the metal hydroxide *particles* are disclosed where it is stated in the Specification that “Al(OH)<sub>3</sub> having an average particle size of 0.8μm”, or larger, are used. See e.g., p. 9, Example 1, etc. Such a slurry is applied to a current collector, dried, and then pressed to have a structure in which the cathode active material particles and the metal hydroxide particles are uniformly mixed with each other (see Fig. 2 below).

Claims 1 and 5 have been further amended to specify that the metal hydroxides are Mg(OH)<sub>2</sub> and Al(OH)<sub>3</sub> with specific size ranges (corresponding to the potentially allowable amendments of Proposed Amendment B, discussed above). Support for these limitations can be found at least in Claim 4 and 10, and in the Examples 1-10, in which average particle sizes of Al(OH)<sub>3</sub> are 0.8 microns (Ex. 1), 1.2 microns (Ex. 7), and 8 microns (Ex. 9); and Mg(OH)<sub>2</sub> with a particle size of 1.0 microns (Ex. 11), 1.5 microns (Ex.12), and 9 microns (Ex. 13). It is noted that the only variations in each of these series of examples (Ex. 1 and 6-9; and Exs. 11-13) is particle size.

Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

#### Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1, 4, 5, and 10 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 6,998,071 (“Maeda”) in view of U.S. Patent No. 4,913,988 (“Langan”).

Claim 6 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Maeda in view of Langan, and further in view of Japanese Patent Publication No. 2002-8718 (“Hibara”).

Claim 7 also stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Maeda in view of Langan and Hibara and further in view of Japanese Patent Publication No. 2002-83632 (“Unoki”).

Applicants therefore respectfully traverse these rejections.

Claim 1 claims cathode for a battery, consisting of: (a) cathode active material particles; (b) metal hydroxide particles having a specific surface area of between 2.5 m<sup>2</sup>/g and

100 m<sup>2</sup>/g, as a cathode additive; (c) a conductive agent; and (d) a binder, wherein the metal hydroxide particles in the cathode are present in an amount of greater than 0 wt% and less than 10 wt%, and the cathode active material particles and the metal hydroxide particles in the cathode are a uniform mixture with each other.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988).

Applicants thus respectfully traverse the rejections and assert that Maeda in view of Langan fails to teach all elements of the instant claims, and particularly fails to teach the particle sizes of Mg(OH)<sub>2</sub> and Al(OH)<sub>3</sub> claimed in instant claims 1 and 5, or that particles of metal hydroxide are distributed or dispersed uniformly with the cathode active material particles as claimed, in contrast to the continuous coating of metal hydroxide on the lithium cobalt oxide as disclosed of Maeda; nor is there any suggestion or incentive to modify Maeda to include metal hydroxide as discrete particles rather than as a coating. Furthermore, there is no suggestion or incentive that would lead the skilled artisan to combine Maeda with Langan as to do so would require modifying the combination to exclude an essential element.

Maeda does not disclose particles

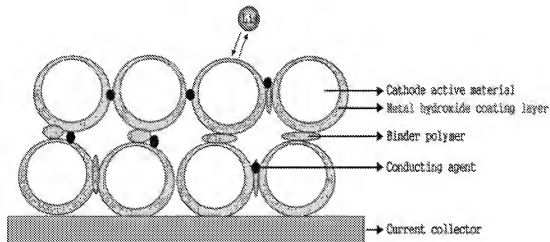
As stated previously, the metal hydroxide included in a cathode component, as claimed in Claim 1 and 5, acts to improve storage properties of the battery at a high temperature. It will further be appreciated that metal hydroxides, as claimed in the instant claim, are nonconductors by nature. A metal hydroxide, if added to a cathode in an excessive amount, may therefore *decrease* battery capacity and degrade storage properties of a battery at a high temperature. Thus, a large quantity of cathode active material particles cannot be coated with the metal hydroxide having the aforementioned amount if it is desirable to have the cathode active material particles in electrical contact with each other.

If a cathode active material were *coated* with the metal hydroxide as to form a layer surrounding the cathode active material particles, the cathode active material particles would be unable to make direct contact with one another through the metal hydroxide coating layer formed on the surface of the cathode active material particles, and cannot therefore be

interconnected “physically” and/or “electrically” from the lack of direct contact of the cathode active material particles due to the intervening the metal hydroxide.

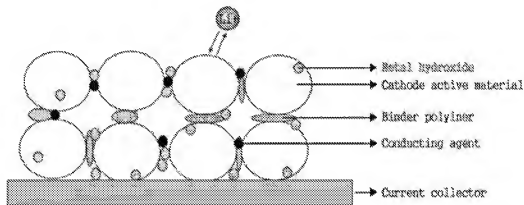
Please again refer to FIG. 1 below (i.e., “metal hydroxide coating layer”), which illustrates this:

FIG. 1



The cathode of Claim 1 and 5 is thus characterized by use of *particles* of the metal hydroxide as a cathode *additive* in a minimal amount and having a specific surface area within a certain range (for example, 2.5 to 100 m<sup>2</sup>/g), and not as a coating. Please refer to FIG. 2 below to illustrate this:

FIG. 2



By using a metal hydroxide in particulate form and having a large specific surface area as the cathode additive, it is possible to obtain *both* the excellent storage properties of a

battery at a high temperature so as to minimize any decrease in battery capacity, *and* to prevent increase of battery impedance that would result from completely coating the particles with metal hydroxide. These desirable features can be obtained even if the metal hydroxide having a high surface area as claimed is added in a relatively small amount (greater than 0 wt% to less than 10%) as claimed in Claim 1 and 5. Further, any decrease in the battery capacity that would arise from the inclusion of higher amounts of metal hydroxide to the cathode may be minimized.

The effect of the improvement in storage properties of the battery at a high temperature (i.e., minimizing the decrease in (or loss of) battery capacity, thereby preventing increase of the battery impedance), as described above, is supported by the description in the Specification on pages 12 to 16 (Storage characteristic test at high temperature) and Tables 1-3 in the Specification.

Applicants respectfully maintain that the combination of Maeda in view of Langan fails to teach all elements of the instant claims. The cobalt oxide particles coated with magnesium hydroxide of Maeda are precursor compounds for forming the cathode active material. Maeda, Col. 6, lines 16-44. Maeda clearly and explicitly states that the cathode active material is prepared from coated cobalt oxide particles (II) by mixing the cobalt oxide particles (I) or (II) with both a lithium compound and an aluminum salt compound (e.g.,  $\text{Al}(\text{OH})_3$ ), and heating the mixture at 600-950°C to form the cathode active material. Maeda, Col. 9, lines 11-15, 39-49.

Maeda teaches that the magnesium hydroxide coats the entire cobalt oxide particle as illustrated in Fig. 1 (above). Specifically, Maeda discloses, in making the magnesium hydroxide or aluminum hydroxide coated cobalt oxide of coated cobalt oxide particles (I') and (II):



where x is 0.001 to 0.15 and y is 0.001 to 0.05, are prepared by forming cobalt oxide particles in solution, adding magnesium and aluminum salt to the reaction solution, and adjusting pH with aqueous alkali, thereby *coating the surface* of the cobalt oxide particle with

magnesium hydroxide or aluminum hydroxide. Maeda, Col. 7, lines 23-33. It will be appreciated that the method using dissolved salts coated by pH adjustment as disclosed in Maeda would lead to a uniform coating, in contrast to the application of a slurry of *discrete particles* of metal hydroxide having a specific surface area and cathode active material particles, as claimed in Claim 1 and 5 and as disclosed in the instant Specification. Maeda therefore clearly discloses a pH-mediated coating process which completely covers the cathode active material, but does not disclose the particulate cathode active material in admixture with metal hydroxide particles as claimed in the instant claims.

Maeda further states that the advantages to the *cathode active material* of Maeda (i.e., large lattice constant) are obtained because when the magnesium hydroxide in precursor (II) is “adhered onto the surface of the cobalt oxide particles, magnesium and cobalt are uniformly distributed in the cathode active material at *atomic level*,” and that “cobalt sites of the cathode active material obtained by using the cobalt oxide particles... (II) can be uniformly replaced with magnesium.” Col. 10, lines 48-59.

Maeda therefore teaches that 1.) only the *precursor* material to the cathode active material (e.g.,  $\text{Co}_3\text{O}_4$ , and not a cathode active material such as  $\text{LiCoO}_2$ ) are coated with metal hydroxide, and 2.) after forming the cathode active material, the magnesium hydroxide coating is intercalated into the cathode active material at *the atomic level*, which does not indicate the presence of the intermittently coated particles as claimed in Claim 1 and as illustrated in FIG. 2 above.

Furthermore, Claim 1 and 5 do not claim a specific surface area for the cathode active material particles, but only for the metal hydroxide coated cobalt oxide precursor to the cathode active material. One skilled in the art will appreciate that these are not identical.

Maeda discloses *coating* individual cobalt oxide particles with magnesium hydroxide as illustrated in FIG. 1, whereas the metal hydroxide claimed in Claim 1 is included as a cathode additive (i.e. cathode slurry additive; see FIG. 2, above).

Further, the invention of Claim 1 is characterized by using the metal hydroxide particle as a cathode “**additive**” in a minimal amount, wherein a specific surface area of the metal hydroxide particle is adjusted to be within a certain range (for example,  $2.5 - 100 \text{ m}^2/\text{g}$ ). Since the claimed invention cannot have a structure of the cathode as described in above FIG. 1, the problems of Maeda (i.e., intermittent interparticle electrical contact) caused by the use



of the magnesium hydroxide coating layer fundamentally do not occur in the invention claimed in Claim 1.

Specifically, where a cathode is formed by using cobalt oxide particles coated with the magnesium hydroxide in Maeda, the cathode active material particles cannot make contact directly with one another due to the intervention of the metal hydroxide coating layer formed on the surface of the cathode active material particles, and thus, as discussed above, cannot be interconnected “physically” and/or “electrically” due to **non-conductivity** of the metal hydroxide.

Thus, the surface of cathode active material in Maeda is surrounded with the metal hydroxide coating layer. Since the metal hydroxide is nonconductor and is not capable of lithium ion intercalation/deintercalation, the metal hydroxide coating layer serves as a resistive layer which interrupts lithium ion movement from the cathode active material during charge/discharge cycles, thereby undesirably *increasing* the battery impedance.

Because Maeda forms a cathode by use of the cobalt oxide particles coated with magnesium hydroxide, it is distinguishable from the claimed invention in terms of constitution. Further, the cathode active material particles coated by the metal hydroxide in Maeda cannot be electrically interconnected, thereby causing degradation in battery performance such as good rate property and high output.

The Examiner states that Maeda discloses that the “composition of the magnesium hydroxide” has a BET surface area as claimed. Applicants disagree. Maeda specifically states that the BET specific surface area of the *coated cobalt oxide particles* is a value of 0.5 to 50 m<sup>2</sup>/g at a particle diameter of *not more than* 0.2 μm (Col. 3, lines 5-12), but does not disclose a specific surface area for discrete magnesium hydroxide (or aluminum hydroxide) particles or the particle size of 0.8 μm or more as claimed in Claim 1. Langan does not disclose manganese or aluminum hydroxide particles having these sizes. Hence, Maeda in view of Langan fails to disclose the surface area for either the metal hydroxide absent the cobalt oxide, fails to disclose the particle size limitations, and does not provide a surface area for the cathode active material prepared from the coated cobalt oxide particles of (II) in Maeda.

“A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int'l*

*Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). To find obviousness, the Examiner must “identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does.” *Id.* Maeda and Langan do not teach or suggest that the specific surface area of the metal hydroxide added to the cathode of the battery is related to the storage properties of the battery at a high temperature, and thus neither of these references provides a suggestion or incentive that would lead one skilled in the art to include a metal hydroxide having a specific surface area as claimed in Claim 1. For at least these reasons, Maeda in view of Langan fails to teach the surface area of the metal hydroxide additive particles, and fails to provide a suggestion or incentive that would lead one skilled in the art to modify the combination to provide the surface area for the metal hydroxide particles.

The Examiner states that Claims 1 and 5 are product-by-process claims. Applicants disagree and note that this is not the intended reading of the claims. The only terms which may be construed as verbs, and which could lead one to interpret the claim as a product by process claims, are “added” and “(uniformly) mixed”; however, each of these terms may be properly understood in a non-verb context, which was the intent of the Applicants. As to the term “added”, this term is used as an adjective to indicate the presence of the metal hydroxide particles; however, as the term is unnecessary, it has been removed and has been replaced by the preposition “in.” The term “uniformly mixed” was intended to convey that the cathode active material particles and the metal hydroxide particles are present in the cathode as a uniform mixture of these particles, which when the word “mixed” is interpreted as an adjective, would be appreciated by the Examiner. As the adverb “uniformly” has been used to modify “mixed”, which is in this instance is an inadvertent grammatical error based on the desired interpretation of the claim by Applicants, Applicants have corrected the grammar to clarify that “uniformly mixed” should be read as “a uniform mixture” which clearly establishes the claim not to include a product-by-process limitation. Applicants respectfully request the Examiner make any further interpretations of the claim in this light.

The Examiner also states that metal hydroxide coated particles of Maeda are “uniformly mixed” (i.e., constitute a uniform mixture) within the scope of Claim 1. Applicants disagree with this conclusion. Even if, *arguendo*, the metal hydroxide coated cathode active material particles are uniformly distributed within the cathode, it has not been

established by the Examiner that a metal hydroxide coated cathode active material particle is the same thing as a mixture of cathode active material *particles* and metal hydroxide *particles* to form a uniform mixture of these *particles* as claimed in Claim 1 and 5. These are clearly different concepts (i.e., a single coated particle in the reference versus a mixture of two different particles as instantly claimed). Maeda requires a uniform coating of metal hydroxide on a particle in which the coated particle and cathode active material are an integral and discrete particulate unit, whereas the uniform mixture claimed in instant Claim 1 and 5 requires uniform distribution of two types of particles. Maeda, therefore, does not disclose separate particles of cathode active material and metal hydroxide as claimed in Claims 1 and 5. There is no suggestion in Maeda that would provide a suggestion or incentive to change the coated particles to a mixture of cathode active material particles and metal hydroxide particles. *In re Laskowski*, 871 F.2d 115, 117, 10 U.S.P.Q.2d 1397, 1398 (Fed. Cir. 1989) (“Although the Commissioner suggests that [the structure in the primary art reference] could readily be modified to form the [claimed] structure, ‘[t]he mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification’”) (citation omitted); *In re Stencel*, 828 F.2d 751, 755, 4 U.S.P.Q.2d 1071, 1073 (Fed. Cir. 1987) (obviousness cannot be established “by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion that the combination be made”). There is no teaching or suggestions to combine elements of the prior art to produce the present invention. The present invention is thus nonobvious.

Also with regard to the combination of Maeda and Langan, Langan, in addition to disclosing calcium hydroxide, includes lithium carbonate ( $\text{Li}_2\text{CO}_3$ ) as an *essential component* constituting the cathode. Langan discloses a composition in which 0.5 to 2 wt% of  $\text{Li}_2\text{CO}_3$  and 0.5 to 6 wt% of  $\text{Ca}(\text{OH})_2$ , where the *combination* of lithium carbonate and calcium hydroxide, when included in a cathode, “affords superior performance under low temperature conditions with no substantial difference in cell performance under normal conditions and after aging at elevated temperatures compared to prior art nonaqueous cells.” Col. 2, line 66 to Col. 3, line 2; Col. 10, line 65 to Col. 11, line 3. Langan therefore discloses that the *combination* of these components is necessary to achieve the desired cell performance, and there is therefore no expectation that the cell performance, relied on by the Examiner, would

be obtained in a combination of Maeda and Langan absent lithium carbonate. Claim 1 does not claim lithium carbonate, and furthermore recites that the claimed composition consists of the recited elements, and therefore Claim 1 and 5 are exclusive of the use of lithium carbonate. As argued previously, to remove lithium carbonate from any combination of Maeda and Langan would alter the principle of operation of Langan and therefore would teach away from its use, or any expectation of success for the combination with Maeda as asserted by the Examiner. In this regard, the courts have held that “[i]f the proposed modification would render the prior art invention being modified unsatisfactorily for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon* 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984). The courts have also held that “[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious.” *In re Ratti* 270 F. 2d 810, 123 USPQ 349 (CCPA 1959). There is therefore no suggestion or incentive in Langan to remove an essential element (lithium carbonate) from the combination of Maeda with Langan, and to thereby obtain the limitations of Claim 1 and 5. Therefore, Maeda in view of Langan does not render Claim 1 unpatentable.

For at least the above reasons therefore, Maeda in view of Langan fails to disclose all elements of the instant Claims 1, and its dependent Claims 4, 7, and 10, and fails to provide a suggestion or incentive that would lead one skilled in the art to modify the combination to provide the missing limitations.

As to the rejections of Claims 6 and 7 over, respectively, Maeda in view of Hibara, and Maeda in view of Hibara and further in view of Unoki, Hibara and Unoki do not remedy the deficiencies of Maeda in view of Langan; and therefore the combinations of Maeda, Langan, and Hibara; and Maeda, Langan, Hibara and Unoki do not disclose all limitations of the instant claims and do not render these claims unpatentable.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise,  
please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

CANTOR COLBURN LLP

By: /Dana A. Gronbeck/  
Dana A. Gronbeck, Ph.D.  
Registration No. 55,226  
CANTOR COLBURN LLP  
20 Church Street, 22<sup>nd</sup> Floor  
Hartford, CT 06103  
Telephone (860) 286-2929  
Facsimile (860) 286-0115  
Customer No.: 23413

Date: May 18, 2010